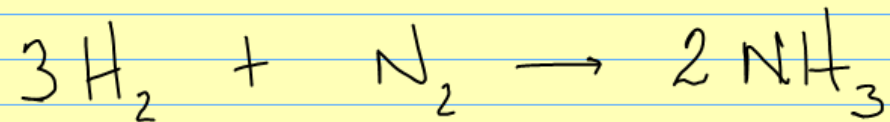


Stoichiometry : Chemical Equations and the Mole

May 10, 2011

Stoichiometry is the relationship between amounts of reactants and products involved in chemical reactions. Stoichiometry is based on knowing the mole ratio between two compounds involved in the reaction. To determine the mole ratio you must begin with a balanced chemical equation.

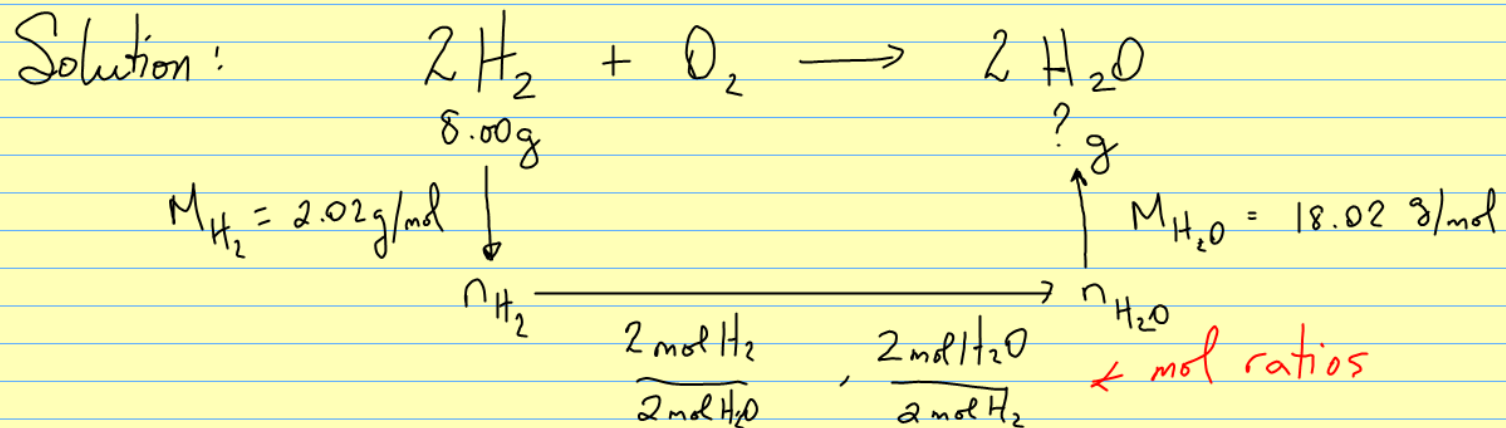
Consider the reaction between hydrogen gas and nitrogen gas to make ammonia. The chemical reaction is:



The mole ratio is determined by the coefficients of the balanced chemical equation. So for this reaction the mole ratio is $3\text{ mol H}_2 : 1\text{ mol N}_2 : 2\text{ mol NH}_3$.

We use the mole ratio in stoichiometric calculations as a conversion factor between moles of one compound and another.

Example #1 : Calculate the mass of water that forms from the combustion of 8.00 g of hydrogen gas.



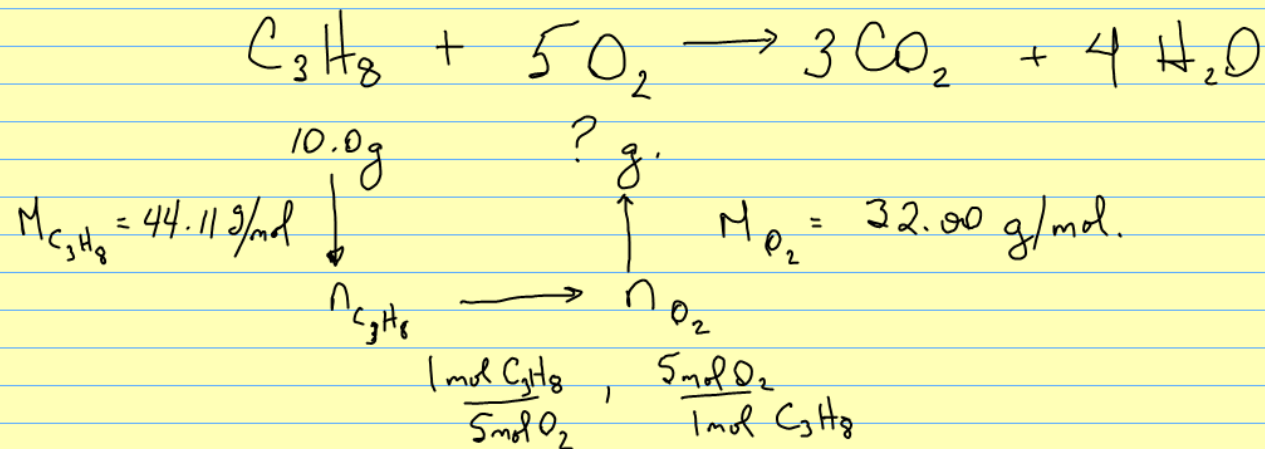
$$n_{\text{H}_2} = 8.00\text{g} \times \frac{1\text{mol}}{2.02\text{g}} = 3.96\text{mol H}_2$$

$$n_{\text{H}_2\text{O}} = 3.96\text{mol H}_2 \times \frac{2\text{mol H}_2\text{O}}{2\text{mol H}_2} = 3.96\text{mol H}_2\text{O}$$

$$m_{\text{H}_2\text{O}} = 3.96\text{mol H}_2\text{O} \times \frac{18.02\text{g}}{1\text{mol}} = 71.3\text{g}.$$

\therefore 71.3g of water is produced.

Example #2 : What mass of oxygen is required for the complete combustion of 10.0 g of propane.



$$n_{\text{C}_3\text{H}_8} = 10.0\text{g} \times \frac{1\text{mol}}{44.11\text{g}} = 0.2267\text{mol C}_3\text{H}_8$$

$$n_{\text{O}_2} = 0.2267\text{mol C}_3\text{H}_8 \times \frac{5\text{mol O}_2}{1\text{mol C}_3\text{H}_8} = 1.133\text{mol O}_2$$

$$m_{O_2} = 1.133 \text{ mol } O_2 \times \frac{32.00 \text{ g}}{1 \text{ mol}} = 36.3 \text{ g } O_2.$$

\therefore the combustion needs 36.3 g of oxygen gas.

Q 148 P 1, 2, 3 Q 1, 2, 3, 4, 5